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## THE FIRST COST OF SHIPS.

BY CHARLES H. CRAMP.

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Not long ago a metropolitan newspaper quoted me in an "interview" as saying that the higher classes of ships could be built as economically in this country as in Great Britain.

This observation called out a number of inquiries and requests for more specific information; among which was a letter from the editor of *THE NORTH AMERICAN REVIEW* offering the pages of that eminent periodical for any elaboration of the subject suggested that might seem proper.

In availing myself of that offer, it is proper to say that I do so, not from desire to provoke controversy, but with a view to clear away some prevailing misapprehension as to the relative state of the shipbuilding industry in this country and abroad, and as to the effect of the alleged or supposed difference in first cost upon the growth of our merchant marine.

The scope suggested by this inquiry is naturally much beyond the limits of a single magazine paper, and, besides, the pressure of daily duties precludes such exhaustive treatment as I should like to give it. Therefore, the tenor of this paper will be that of a cursory survey of the most recent achievements in shipbuilding and their effects upon the conditions of ocean steam traffic.

A review of the comparative history of British and American shipbuilding from the foundation of our republic would be interesting and instructive, as showing a steady tendency to superior workmanship and more elaborate finish on the part of American builders, class for class and rate for rate, whereby a factor of greater first cost was established, independent of any other conditions; but space and time forbid anything more than reference to it as a fact.

Coming immediately to the subject matter of the existing state of things, it may be said that there is perhaps no topic which so many men discuss, and so few comprehend, as the technique of shipbuilding. This fact is gratifying as an evidence of

growing public interest, but it often gives rise to amusing *contretemps*. For example, the frequenters of the smoking-room of one of our great trans-Atlantic liners, in a recent passage, had been treated to a voluble disquisition on the comparative "lines" of certain rival steamers. Persons not familiar with the subject were profoundly impressed with the belief that this gentleman was an authority. Finally one of the listeners interrupted the discourse to inquire what the gentleman understood the term "lines of a ship" to mean. He was unable to define the term at all. It is this fact of limited public knowledge that makes misapprehension so easy, and accurate information so hard to convey.

The simple question, Can you build a ship as cheaply in the United States as in England? is as impossible of direct positive or negative reply as would be the question, Can a man be educated as cheaply in one country as in the other?

The absurdity of the latter question would be manifest, because any one could see that it depended partly on the man and partly on the education. In different ways, but in a similar generic sense, the principle would apply to the first question, and the answer would be that it depended partly on the ship and partly on the builder.

With regard to the simpler and plainer types of vessels, such as are used for freighting mainly, it is not worth while to discuss them here. The question solves itself to any one of average intelligence who will go aboard and compare the workmanship, style, finish, and general range of seaboat qualities as between any freight vessel like those of the Metropolitan Line or the Morgan Line or the Clyde Line, for example, and the usual English tramp of approximately equal burthen.

Put the plans and specifications of the average English tramp in the hands of an American shipbuilder, and he could not duplicate her. He would build a better vessel, of superior workmanship and neater finish in every respect; for the reason, to put it broadly, that the mechanics who make up an American shipyard organization are trained to a grade of performance which they could not reduce to the standard of tramp-construction.

Under these circumstances this branch of the subject may be dismissed summarily, with the statement that an English freight ship of the usual type could not be duplicated in this country at

any cost. Whether our superior standard in vessels of this class is an advantage or a disadvantage in competition I will not attempt to decide.

Coming to the highest class of vessels,—that is to say, the most recent trans-Atlantic liners, which are rated first in speed and accommodations,—the attention of the world is now directed to certain conspicuous ships. These are the “Columbia,” the “City of Paris” and “City of New York,” and the “Teutonic” and “Majestic.”

In model these vessels show no improvement over the best American or British model of thirty years ago. Dividing them and the types which they represent into three groups, we find them distinguished by marked differences of form and construction, and also of machinery detail, but there is little difference in outfit or engine performance.

The recent award by the Cunard Company of the contract for a new ship to the Fairfield works, of which Dr. Elgar, late superintendent of dock yards, is naval architect, will probably develop a fourth type.

It is not my purpose to go into an exhaustive analysis of the peculiarities of these several types, and I have introduced the fact of their existence partly because I have seen no previous reference to it and partly to preface some remarks more directly pertinent to the main points of my theme. Thus, when one uses the term “British ships” for purposes of comparison with “American ships,” it is calculated to mislead, because the inference would be that all “British ships” were alike; or, at least, that the similarity of type, model, mode of construction, cost, etc., class for class, was sufficiently close to make the national designation alone an adequate basis for comparison.

Nothing could be further from the truth. Every great ship-yard, of long existence and extensive output, acquires methods, systems, and practices peculiarly its own, and these in turn express themselves in the characteristics of vessel which it designs and builds.

The result is that, while there may not be much difference in the average performance between vessels of the same class by different builders, so far as speed, endurance, cost of operating, and annual expense of repair are concerned, there will be material difference in the means and methods by which these results are

reached, and hence a corresponding disparity in estimates of first cost. A Harland & Wolf ship will not be a Thomson ship, nor a Laird ship, nor an Elder ship ; and the same rule will apply to further comparisons between the others.

An error quite prevalent is the supposition that whenever a trans-Atlantic steamship company decides to add a new first-rate vessel to its fleet, complete plans, specifications, etc , are prepared and submitted to a number of competent shipyards for competitive bidding, after the fashion of the United States in its navy contract work. As a matter of fact, this sort of thing never occurs. As a rule, each company has its particular or favorite builder ; and often they are associated financially.

The builders' type of ship becomes the company's standard for service. The excellences of the type have been ascertained by experience, and opportunity has occurred to detect and remedy any defect. Hence the steamship company and the builders work together, and their coöperation results in the growth of a fleet having a reputation of its own and with it, to a very great extent at least, a settled class of public patronage.

In short, the business, in a certain way, is governed by the general commercial rule that public patronage is largely a matter of habit, and that in making use of ships, as of other wares, people continue to patronize that which has suited them once.

There are many shipyards in Great Britain ; more than in the rest of the world combined; but, so far as my observation enables me to judge, there are not more than three or, at the outside, four yards which would be considered by any of the great steamship companies in connection with a first-rate modern vessel such as is now required for trans-Atlantic mail and passenger service.

As before intimated in referring to the diversity of types, vessels of this class involve specialties of model, motive power, structural character, and quality of equipment, which, it may be said, make them *sui generis*, and in many particulars it is impossible to form an advance estimate of cost without a very liberal margin for contingencies. These facts are well understood in England, and their logic is invariably observed in negotiations for building such ships. It often happens that, after the general scheme and approximate price have been agreed upon, achievements elsewhere make expedient certain departures from the original.

In this connection it is worth while to bear in mind that dur-

ing the construction of the "Majestic" and "Teutonic" at the Belfast yards, for the White Star Company, work was suspended for several months pending consideration of material changes, some of which were adopted and others rejected.

But these conclusions were not hastily reached, and were based upon actual observation of the behavior of rival ships built elsewhere. Under an iron-clad contract, with arbitrary fixing of specifications and price, this could not have been done without friction. It may be that there are good reasons why the United States Government should to a great extent tie both its hands and those of the contractors by inflexible written stipulations under bond and penalty; but no such conditions are imposed in transactions between steamship companies and shipbuilders of established rank, for the simple reason that both would be subject to probable or possible embarrassment thereby, and experience demonstrates that it is better to leave the mass of detail to the operation of the common rules of business as encountered in the progress of the work.

From these observations it ought to be tolerably clear that the question, for example, Can you duplicate the "City of New York," or the "Majestic," or the "Columbia"—using the word "duplicate" in the purely structural sense—for the cost of those vessels in Great Britain? would be putting the matter in an impracticable form. The "City of New York" is a product of the peculiar methods, practices, and systems of the Thomsons, of Clyde bank; the "Majestic" similarly represents the Belfast yard of Harland & Wolf, and the "Columbia," the Lairds, of Birkenhead.

In each case the vessel is of a special type, and embodies idiosyncrasies which no other establishment could imitate—at all events, not at equal cost.

The proper form in which to put the question is: Can you build a ship to do the work of the "City of New York" or the "Majestic" or the "Columbia," in all respects, for the same cost? To that question I would reply: Yes, or within as small a margin as would be likely to prevail in a similar case between any two British shipyards.

Our ship might differ from the "City of New York" in the ratio of principal dimensions, in the type of machinery, in style of finish, in fittings, equipment, and accommodations, and in many other things, as sanctioned by our experience or approved

in our particular practice ; but she should exhibit at least equal performance in speed, seaworthiness, comfort, durability, and, all other things being equal, in economy of operation.

But the point which I wish to accentuate is that the ship would be of our type and our model, and would embody our methods, our systems, and our practices ; she would not be a duplicate or an imitation of any other ship, whether British or otherwise. A proper apprehension of this point and an adequate realization of the importance of its bearing upon any question as to the comparative first cost of high-class vessels in this country and in England are absolutely essential to practical or valuable knowledge on the subject.

In this connection I will refer briefly to a phase of the subject which I have exploited at other times in the numerous inquiries that have been made by committees of Congress.

That is the fact that the "first cost" of ships is not only not a prime factor, but it is not even a serious factor, in any competition that may occur between this country and Great Britain for a share of the traffic of the ocean.

My views in that direction are, perhaps, well enough known to make repetition of them here unnecessary, and I do not know that I could say anything that would affect any differences of opinion which may exist.

I simply state the fact as such, in order to preface the further and more important statement that growth of demand for new ships, with its resultant development of contributory industries in steel and iron and other materials of construction, its enlargement and improvement of plant and personnel employed, its natural incentive to greater energy and enlarged enterprise, and, above all, its assurance of security and perpetuity in the business, would speedily wipe out any small margin that may now exist against us in the matter of first cost, generally speaking.

Whatever else may be needed to restore the United States to its footing as a maritime power I leave to the patriotism and wisdom of our legislators to determine.

Referring, in conclusion, to the inquiry as to the relative cost of construction for navy account in the two countries, it must be borne in mind that disparities in bases of comparison exist in that direction even greater than in merchant shipbuilding.

In Great Britain public patronage in great amount has been  
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constantly and consistently extended to private enterprise, from time immemorial. Here, excepting the abnormal period of the Civil War, government patronage of private shipyards is a thing of recent growth ; not more than seven or eight years old.

The evolution of the modern war-ship in England was a steady and natural growth ; the strides of progress were short and easy, and all contributory industries were concurrently developed by equally easy stages. There was no sudden transition ; no leap into unknown or untried fields. From the first iron war-ship of any note—the old “Warrior,” in 1857—up to the “Hood” and the “Royal Sovereign,” first-rate battle-ships of 1891, there was a rate of progress the steps of which were as regular as the ticking of a clock. At all times and under all conditions the shipbuilding industry of Great Britain has been of paramount national importance ; recognized as such by every public authority and fostered as such by every public power.

The advantageous effect of such a state of affairs may be best apprehended by contrast with the conditions under which American shipbuilders undertook, a few years ago, the task of rebuilding the United States Navy.

On November 7, 1881, just ten years ago at this writing, the first Naval Advisory Board reported a general scheme of naval reconstruction. The assembly of this board was one of the acts of the Garfield administration. From it may be dated the prevailing consistent policy of the *new navy*, though actual construction was not begun until about two years later.

At the outset it was resolved that we must have ships of the latest approved standard in every respect of material, armament, and equipment. When the work began, there were, say, three shipyards that the Navy Department considered competent to undertake it. But there was no steel-mill that had ever made plates and shapes of the quality required by the government specifications ; no foundry that had ever made steel castings of that standard ; no forge capable of making the steel shafts, or the tubes, jackets, and hoops required for the motive power of the ships or for the built-up breech-loading rifled cannon of large calibre wherewith to arm them ; and no plant able to even entertain a proposition for the heavy armor-plates necessary in the construction of fighting ships. To such an extent was this true that the steel shafts for the earlier ships, the forgings for the pioneer

eight-inch guns, and the compound armor for the turrets of the monitor "Miantonomoh" were all imported.

Without going into tedious detail of these preliminary operations, it may be said in bulk that we not only had to build ships of even a higher grade than their contemporaries abroad, with no commensurate initial resources, but we had to create a new group of industries in every branch of the art of steel-making to supply us with the necessary material.

Under these circumstances American shipyards have built or are building about forty naval vessels of numerous rates and types, all of the very highest and most effective class in the world; and this development has been crowded into a space of about seven years. To put the case a little stronger, you may say that, with only the existing authorized construction in view, this country will have the third navy in the world within less than ten years, from a starting-point which may be described as at zero !

By that time we will have four first-rate battle-ships, six powerful double-turreted monitors, two heavy-armored cruisers, thirteen large protected cruisers, two of which are the fastest and most effective in the world, and fifteen smaller vessels of from 2,000 tons down to first-class torpedo boats.

In addition to these achievements we have developed on our own soil forging, foundry, and rolling plants with capacity of production, as to size or quality, equal to any in the world ; and all this has been built, you may say, literally "from the ground up."

To state the case in another phrase, we have, in a comparatively brief period. accomplished practical results commensurate with those due to steady growth during many years abroad.

Manifestly it must have been impossible to carry all these things along together at such a rapid pace and to surmount so many initial difficulties with such celerity at a normal cost. No one conversant with the laws of trade would expect it. But it is a well-known and admitted fact that a decrease in cost per ton of displacement, or per indicated horse-power of machinery, or per foot-ton of ballistic energy in our guns, or per unit of effective resistance in our armor, has quite kept pace with our growth of facilities and our enlargement of output.

The disparity in cost of naval ships between our yards and those of Great Britain, ton for ton, gun for gun, and performance for performance, has dwindled in seven years until, in the

case of the three latest battle-ships, the margin between our prices and those of similar constructions abroad may be expressed by a very small figure. To illustrate the rapidity of progress in this direction I will call attention to the fact that Congress, by an act approved June 30, 1890, authorized the construction of three battle-ships of "about 8,500 tons' displacement," to cost "not more than four million dollars each, exclusive of armament"; and the vessels now building under the provisions of that act are of 10,400 tons' displacement, or nearly 25 per cent. larger and more efficient than those contemplated by Congress, with a margin on each ship of over \$800,000 for fixed armor and other necessary deductions.

Gratifying as this prodigious development of new and great industries may be in the warlike sense, and in view of its guarantee of our independence as a nation for defence or for offence, its peaceful significance is still more profound.

At this writing there are plants and organizations in the United States capable of producing in any quantity, and of the highest quality, any structure in steel or iron or brass, or any other metal, that can be produced anywhere; a state of things which did not exist seven years ago, and the present existence of which is a direct outcome of the enterprise and energy called forth by the rebuilding of the navy. In my opinion it must be a pretty poor American who is not proud of such achievements in so short a time.

With regard to the character of the vessels built or building for the navy, so much has been said about it in the daily press, and public interest has been so constantly and so cordially expressed in every form, that comment here would seem unnecessary. Suffice it to say that it is the universal testimony, both of our own sailors who have been abroad in the new ships and of candid foreigners who have seen them, that they are excelled by none and equalled by but few in their respective classes anywhere.

If the current policy of naval reconstruction be pursued for another decade, coupled with a vigorous and consistent execution of the measures recently enacted in behalf of the merchant marine, the question which forms the subject of this paper will be asked no more; unless, indeed, its point should be reversed and Englishmen be asking one another, Can we build ships as economically as they can in the United States?

CHARLES H. CRAMP.